# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

| Applicant's or agent's file reference PCTJP40014 | **FOR FURTHER ACTION** See Form PCT/IPEA/416 | |
|---|---|---|
| International application No. PCT/JP2005/000735 | International filing date *(day/month/year)* 14.01.2005 | Priority date *(day/month/year)* 16.01.2004 |
| International Patent Classification (IPC) or national classification and IPC INV. H01M8/06 B01D71/40 B01D71/42 B01D69/10 B01D69/12 | | |
| Applicant TOYOTA BOSHOKU KABUSHIKI KAISHA et al. | | |

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 3 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

| | | |
|---|---|---|
| ☒ | Box No. I | Basis of the report |
| ☐ | Box No. II | Priority |
| ☐ | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| ☐ | Box No. IV | Lack of unity of invention |
| ☒ | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| ☐ | Box No. VI | Certain documents cited |
| ☐ | Box No. VII | Certain defects in the international application |
| ☐ | Box No. VIII | Certain observations on the international application |

| Date of submission of the demand | Date of completion of this report |
|---|---|
| 11.11.2005 | 14.06.2006 |
| Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465 | Authorized officer Horváth, L Telephone No. +49 89 2399-2110 |

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/JP2005/000735

## Box No. I Basis of the report

1. With regard to the **language**, this report is based on

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3(a) and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4(a))
   - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

**Description, Pages**

| | |
|---|---|
| 1-13 | as originally filed |

**Claims, Numbers**

| | |
|---|---|
| 3, 7, 8, 11-14 | as originally filed |
| 1, 2, 4-6, 9, 10 | received on 21.11.2005 with letter of 17.11.2005 |

**Drawings, Sheets**

| | |
|---|---|
| 1/4-4/4 | as originally filed |

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☒ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☒ the claims, Nos. 3,7,8,11-14
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/JP2005/000735

**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

| | | | |
|---|---|---|---|
| Novelty (N) | Yes: | Claims | 1-2,4-6,9-10 |
| | No: | Claims | |
| Inventive step (IS) | Yes: | Claims | |
| | No: | Claims | 1,2,4-6,9-10 |
| Industrial applicability (IA) | Yes: | Claims | 1-2,4-6,9-10 |
| | No: | Claims | |

2. Citations and explanations (Rule 70.7):

**see separate sheet**

## 1. Cited documents:

D1: PATENT ABSTRACTS OF JAPAN vol. 2000, no. 15, 6 April 2001 (2001-04-06) & JP 2000 334229 A (KEIO GIJUKU), 5 December 2000 (2000-12-05)

D2: US 2003/153457 A1 (NEMOTO YASUSHI ET AL) 14 August 2003 (2003-08-14)

D3: PATENT ABSTRACTS OF JAPAN vol. 1998, no. 14, 31 December 1998 (1998-12-31) & JP 10 235129 A (MATSUSHITA ELECTRIC WORKS LTD), 8 September 1998 (1998-09-08)

D4: US 2003/064271 A1 (STENERSEN EIVIND) 3 April 2003 (2003-04-03)

## 2. Novelty:

2.1. None of documents D1-D5 discloses an air supply system for a fuel cell with the combination of features found in claim 1. The closest prior art document is considered to be D4, which discloses an air supply system for a fuel cell, an air filter assembly 100 comprising a particulate filter 114 and a first chemical filter element 112a and a second chemical filter element 112b. The two chemical filter elements 112a, 112b are considered to be the equivalent of the gas removing device of claim 1. The chemical filter elements of D1 can contain activated carbon, including carbon fibres, impregnated carbon and others. These materials can also be coated or impregnated, with various materials, like citric acid, phosphoric acid, other acidic materials, or mixtures thereof (see par. 28, 29, 30, 31,). D4 doesn't disclose an alternate adsorption membrane formed on each of the activated carbon fibres with alternating positively and negatively charged layers.

2.2. For the above mentioned reasons claims 1,2,4,5,6,9,10 are novel over documents D1-D5 under Art.33(2) PCT.

## 3. Inventive step:

3.1. The closest prior art document is considered to be D4 as discussed under the paragraphs referring to novelty. The problem to be solved by D4 is that the life, durability and performance of fuel cells are greatly affected by the quality of air used as the oxygen source for the cathode side of the fuel cell. It is also mentioned that the cathode catalyst

and the electrolyte can be temporarily or permanently poisoned or damaged by any number of various contaminants, such as sub-micrometer particulate matter, sulfur compounds, VOCs, salts and $NH_x$. The object of D4 is to maximize the performance, life and durability of fuel cells, by maximizing the performance of the contaminant control system (see par. 4). The problem of the present application as stated in the desc., page 1, line 23 - page 2, line 2 is to prevent the impurity gas particles being dissociated from the micro pores of the adsorbent material.

3.2. The difference between the solution offered by D4 and the subject matter of claim 1 is that in claim 1 the activated carbon fibres have an alternate adsorption membrane comprising at least one positively charged layer and at least one negatively charged layer alternately laid together.

3.3. D4 discloses the fact that activated carbon, including carbon fibres can be coated, combined with, or impregnated with certain types of materials, like citric acid, phosphoric acid, other acidic materials and others, or mixtures thereof. It is also specifically disclosed that in some embodiments, the adsorbent material can be combined or impregnated with a second material to enhance the absorbing properties of the base material. While D4 doesn't specifically disclose negatively and positively charged layers alternately laid together, the suggestions with regard to the possibility of coating the activated carbon fibres to enhance adsorption, would make a skilled man apply the teachings of document D1 to the air supply and contaminant control system of D4.

3.4. The problem of D1 is to provide an inexpensive air filter high in adsorption efficiency of particles, molecules and ions. The problem of D1 is identical with the problem of the present application, as stated on page 2, lines 4-7. In the filter of D1 the porous fibre glass base can absorb part of the impurity particles contained in air. As a base material a sponge, polypropylene, polyurethane, polystyrene, a nonwoven fabric can also be used. In addition the particles S (see fig.8), which intrude into the alternating adsorption membrane with a porous structure, are adsorbed physically by the Coulomb force due to the PAH membranes or the PAA membranes. Because of the coulomb force the particles cannot be easily dissociated from the adsorption layer. As application fields of this filter D1 mentions the possibility of filtering out cigarette smoke from air. It is also mentioned that exhaust gases can also be efficiently absorbed with this type of filter. Although activated carbon fibres are not specifically mentioned in the document as a suitable base material, a skilled man would know how to apply the technology disclosed by D1 to the activated carbon fibre substrate of D1.

3.5. With regard to the above arguments claim 1 lacks an inventive step over D1 and D2 under Art. 33(3) PCT.

3.6. Claim 4 comprises the additional feature that the activated carbon fibres are formed into a non-woven fabric. However activated carbon in the form of a non-woven fabric is known in the art, for instance from D2, par.15, 16.

3.7. The subject matter of claims 5-6 is not disclosed by the prior art. It is however unclear what the surprising new technical effect of the combination of the activated carbon fibres with the resin fibres is. For this reason claims 5-6 lack an inventive step over the prior art documents D1-D4.

3.8. The subject-matter of claims 9-10 is known from document D1, therefore they lack an inventive step over D1 and D2, under Art.33(3) PCT.

**4. Clarity:**

4.1. Claim 2 lacks clarity under Art. 6 PCT because it is impossible that all micro pores are directly exposed to the outside of the activated carbon fibres.